PATENT SPECIFICATION (11) 1 441 077

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(21) Application No. 39620/74 (22) Filed 10 Sept. 1974 (19)
(31) Convention Application No. 103428/73 (32) Filed 13 Sept. 1973 in
(33) Japan (JA)
(44) Complete Specification published 30 June 1976
(51) INT. CL.² B29H 7/00
(52) Index at acceptance
B5K 3

(54) IMPROVEMENTS IN OR RELATING TO SPLICING PARALLELOGRAMMATIC PIECES OF RUBBERISED FABRIC WITHOUT OVERLAP

(71) We, THE YOKOHAMA RUBBER CO. LTD., of No. 36-11, Shimbashi 5-chome, Minato-ku, Tokyo, Japan, a corporation organised under the laws of Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for successively splicing parallelogrammatic pieces of rubberised fabric, and more specifically to apparatus for joining successive pieces of rubberised fabric end to end without overlap for use later in the manufacture of vehicle tires.

It is customary in the tire manufacturing industry to splice a number of parallelogrammatic pieces of rubberised fabric to provide an elongate strip of each rubberised fabric pieces as an intermediate product. The parallelogrammatic pieces of rubberised fabric are formed by cutting a continuous, selvaged strip of the rubberised fabric either biaswise or crosswise, and the desired elongate strip of these rhomboidal or rectangular rubberised fabric pieces is produced by successively joining their selvages. For use the elongate strip is again cut into pieces sized to suit the particular size of tires to be built.

For the manufacture of high-quality tires, it is of absolute necessity that the above described elongate strip of rubberised fabric pieces be produced by evenly joining the selvages of the adjacent pieces. There are two well known methods of producing the elongate strip of rubberised fabric pieces. One of the methods is herein termed "lap splice" wherein the joint is formed by overlapping the opposed edges and by forcing them against each other. The other is termed "butt splice" wherein the two opposed edges are joined without overlap. Lap splice tends to cause irregularity in thickness and/or strength at the lapped joints, which defect is substantially absent from butt splice. Generally, butt splice is far preferable to lap splice, principally from the standpoint of the provision of evenly joined rubberised fabric pieces.

Butt-splicing apparatus has been known which comprises a splicer mechanism and two belt conveyors positioned forwardly and backwardly, respectively, of the splicer mechanism. Each parallelogrammatic piece of rubberised fabric is fed forwardly into the splicer mechanism by one of the belt conveyors, whereas the precedingly spliced rubberised fabric piece is fed backwardly into the splicer mechanism by the other belt conveyor. The rubberised fabric pieces are retained in respective predetermined positions in the splicer mechanism and are then forced into end-to-end abutment against each other for butt-splicing operation.

For the correct butt-splicing of rubberised fabric pieces, their opposed edges must be held exactly in parallel spaced relationship when the rubberised fabric pieces are stopped in their respective predetermined positions in the splicer mechanism, and further this parallel relationship must be faithfully maintained as they are succeedingly forced into end-to-end abutment. The belt conveyors employed as feed mechanisms in the prior art butt-splicing apparatus, however, are incapable of correctly reorienting the rubberised fabric pieces being fed into the splicer mechanism, due in part to the adherent and highly pliable properties of the rubberised fabric. This is the principal reason why the splicer mechanism as heretofore constructed is complicated with extra means for readjusting the positions of the successively supplied rubberised fabric pieces.

It is, therefore, an object of this invention to provide simple, inexpensive and highly efficient apparatus for successively butt-splicing parallelogrammatic pieces of rubberised fabric in such a manner that there is hardly any irregularity in thickness or strength at the joints of the rubberised fabric pieces butt-spliced into the form of an elongate strip.

According to the invention, there is provided apparatus for successively splicing parallelogrammatic pieces of rubberised fabric without overlap, comprising in combination:

(a) a forward vibratable conveyor for successively feeding the pieces of rubberised fabric forwardly by vibration, said forward vibratable conveyor including means for reorienting and guiding lateral edges of the successive pieces of rubberised fabric travelling thereon;

(b) a butt-splicer for joining the successive pieces of rubberised fabric end to end without overlap, said butt-splicer including:

(1) a rear table mounted forwardly of said forward vibratable conveyor for receiving the successive pieces of rubberised fabric therefrom, said rear table having an edge remote from said forward vibratable conveyor;

(2) a rear retractable stop;

(3) means for moving said rear retractable stop between an operative position for arresting the forward movement of each piece of rubberised fabric in a prescribed position on said rear table and an inoperative position away from the plane of said rear table, the piece of rubberised fabric having its leading edge projecting a prescribed distance beyond said edge of said rear table when stopped in said prescribed position thereon;

(4) a rear clamping platen;

(5) means for moving said rear clamping platen between an operative position for clamping the piece of rubberised fabric against said rear table in said prescribed position and an inoperative position for releasing the same;

(6) a front table mounted forwardly of said rear table in coplanar relationship thereto, said front table having an edge opposed to said edge of said rear table;

(7) a front retractable stop;

(8) means for moving said front retractable stop between an operative position for arresting in a prescribed position on said front table the movement of the precedingly spliced piece of rubberised fabric as the same is fed backwardly and an inoperative position away from the plane of said front table, the precedingly spliced piece of rubberised fabric having its trailing edge projecting a prescribed distance beyond said edge of said front table when stopped in said prescribed position thereon;

(9) a front clamping platen;

(10) means for moving said front clamping platen between an operative position for clamping the precedingly spliced piece of rubberised fabric against said front table in said prescribed position thereon and an inoperative position for releasing the same; and

(11) means for moving at least one of said front and rear tables towards and away from the other whereby said opposed edges of said front and rear tables can be forced into abutting contact with each other for splicing operation;

(c) a backward vibratable conveyor mounted forwardly of said butt-splicer for selectively feeding the precedingly spliced piece of rubberised fabric backwardly to said butt-splicer by vibration, said backward conveyor including means for reorienting the piece of rubberised fabric travelling backwardly thereon; and

(d) take-up means for carrying the spliced pieces of rubberised fabric away from said butt-splicer via said backward vibratable conveyor by indexed movement.

The forward vibratable conveyor is adapted to feed each parallelogrammatic piece of rubberised fabric to a prescribed position on the rear table of the butt-splicer, and the backward vibratable conveyor to feed the precedingly spliced ruberised fabric piece back to a prescribed position on the front table of the butt-splicer. The forward and backward vibratable conveyors can be of substantially the same construction, both including means for reorienting and laterally guiding the edges of the rubberised fabric pieces being fed into the butt-splicer.

The butt-splicer can be of practically the simplest construction since the rubberised fabric pieces are fed thereinto in a correctly oriented manner as above stated. Basically, the butt-splicer comprises front and rear retractable stops for arresting the backward and forward movements of the rubberised fabric pieces in the prescribed positions on the front and rear tables, respectively, front and rear clamping platens for clamping the respective rubberised fabric pieces against the tables in the prescribed positions thereon, and means for moving at least one of the tables into forced abutting contact with the other for butt-splicing of the rubberised fabric pieces. The take-up means, which can be in the form of a belt conveyor, carries the butt-spliced rubberised fabric pieces away from the butt-splicer via the backward vibratable conveyor by indexed movement.

In view of the fact that the shape of rubberised fabric pieces used for vehicle tire building may be either rectangular (for use, for example, in radial-ply tires) or rhomboidal (bias-ply tires), the angular position of the front and rear tables of the butt-splicer according to the invention is prefer-

ably made adjustable in a horizontal plane to permit the apparatus to handle both types of pieces. In a preferred embodiment of the invention hereinafter presented, this objective is accomplished simply by revolving a hand wheel. The angular position of the front and rear clamping platens and so forth coacting with the tables for butt-splicing operation can simultaneously be adjusted by the revolution of the hand wheel.

So that the invention will be more readily understood and features thereof made apparent, an embodiment of the invention will now be described with reference to the accompanying drawings. In the drawings, like reference numerals denote like parts in the several views. In the drawings:—

Figure 1 is a side elevational view of rubberised fabric splicing apparatus according to the invention;

Figure 2 is a top plan view of the apparatus shown in Figure 1;

Figure 3 is a side elevational view showing the details of a forward vibratable conveyor used in the apparatus shown in Figures 1 and 2;

Figure 4 is a top plan view of a plate used in the forward vibratable conveyor shown in Figure 3;

Figure 5 is a right-hand end elevational view of the forward vibratable conveyor shown in Figure 3;

Figure 6 is an enlarged sectional view taken along the plane of line VI—VI in Figure 3;

Figure 7 is an enlarged sectional view taken along the plane of line VII—VII in Figure 2;

Figure 8 is an enlarged sectional view taken along the plane of VIII—VIII in Figure 2;

Figure 9 is also an enlarged sectional view taken along the plane of line IX—IX in Figure 2;

Figure 10 is a plan view taken along the plane of line X—X in Figure 9;

Figures 11A to 11H inclusive are schematic side elevational views sequentially showing a complete cycle of splicing operation by the apparatus shown in Figures 1 and 2; and

Figure 12 is a time chart explanatory of automatic operation of the apparatus shown in Figures 1 and 2.

Figures 1 and 2 of the drawings represent, in side elevational and top plan views respectively, the general arrangement of a preferred form of the splicing apparatus according to this invention. Seen at 15 in these drawings is a vibratable conveyor adapted to feed each parallelogrammatic piece of rubberised fabric 16 forwardly to a butt-splicer 17 which joins the successive rubberised fabric pieces end to end without overlap. Another vibratable conveyor 18 is mounted next to the butt-splicer 17 to feed the precedingly spliced rubberised fabric piece 16*a* backwardly to the butt-splicer. The first mentioned vibratable conveyor 15 is therefore herein called the forward vibratable conveyor, and the second mentioned vibratable conveyor 18 the backward vibratable conveyor, by way of distinction. A take-up conveyor 19 is further mounted forwardly of the backward vibratable conveyor 18 for carrying the successive spliced rubberised fabric pieces away from the butt-splicer 17 via the backward vibratable conveyor by indexed movement.

Although not shown in the drawings, it is understood that each parallelogrammatic piece of rubberised fabric 16 is formed by cutting a continuous strip of such rubberised fabric into a desired length and at a desired angle by suitable means. The rectangular pieces of rubberised fabric shown in Figure 2, purely by way of example, are intended for use in the manufacture of radial-ply tires. The aforesaid continuous strip of rubberised fabric may be cut on the bias by the so-called bias cutter to provide rhomboidal rubberised fabric pieces for use in the manufacture of bias-ply tires.

Figures 3 to 6 inclusive illustrate the construction of the forward vibratable conveyor 15 in greater detail. As best shown in Figure 6, the forward vibratable conveyor 15 includes a flat plate 20 having an enclosed space 21 thereunder and a guide plate 22 along one of the lateral edges thereof. The plate 20 is connected via coiled springs 23 to a vibratable plate 24 on which there is mounted a vibrator 25 of any known or suitable construction, as will be seen from Figures 3 and 5. The vibratable plate 24 is further mounted on a base 26 via coiled springs 27.

It will appear from a consideration of Figures 3 and 5 that the top surface of the base 26 is inclined toward the side of the guide plate 22 at an angle α, and toward the butt-splicer 17 at an angle β, with respect to the plane of the horizon. The plate 20 and the vibratable plate 24 are inclined at the same angles toward the guide plate 22 and the butt-splicer 17 respectively, for purposes hereinafter made apparent.

Figures 4 and 6 best illustrate a number of perforations 28 formed through the plate 20 in communication with the enclosed space 21 thereunder. These perforations are calculated to cause the escape therethrough of the air which tends to be trapped under the rubberised fabric piece 16 as the same is transported over the plate by vibration. The enclosed space 21 may be maintained at atmospheric or slightly negative pressure during operation of the apparatus. Although the provision of this enclosed space 21 and perforations 28 is confirmed to result in the

substantial increase in the speed of transportation of each rubberised fabric piece over the plate 20, they may be dispensed with altogether. While the same objective is likewise substantially accomplished by the aforementioned angle of inclination β of the plate toward the butt-splicer 17, it is also not of absolute necessity to incline the plate toward the butt-splicer.

However, it is preferable, or indeed essential, that a row of perforations 29 be formed through the guide plate 22 at appropriate spacings as seen in Figures 3 and 6, in order to cause the escape therethrough of the air trapped under each rubberised fabric piece traveling over the plate 20. For, were it not for these perforations 29, the rubberised fabric piece would not be properly fed forwardly of the forward vibratable conveyor 15 but would tend to move laterally away from the guide plate 22 due to the streams of air escaping from between the guide plate and the opposed lateral edge of the rubberised fabric piece. It has been confirmed that such lateral displacement of the rubberised fabric piece cannot be prevented merely by the provision of the perforations 28 through the trough 20.

The backward vibratable conveyor 18 shown in Figures 1 and 2 is of substantially the same construction as the forward vibratable conveyor 15 except that the vibrations of the former are so produced as to impart backward feeding motion to the precedingly spliced rubberised fabric piece 16*a*. No more description will therefore be given on the construction of this backward vibratable conveyor.

Figures 7 to 10 inclusive are all directed to the structural details of the butt-splicer 17. A stationary mount of the butt-splicer is shown at 30, and a pair of parallel spaced cam plates 31 are fixedly mounted on the mount 30 on both lateral sides thereof in coplanar relationship to each other. Each cam plate 31 has longitudinally spaced arcuate slots 32 and 33 therethrough, as best shown in Figure 10, and cam follower pins 34 and 35 extending downwardly from each of a pair of slide plates 36 slidably mounted on the respective cam plates 31 are slidably received in the respective arcuate slots 32 and 33. The slide plates 36 are thus constrained to rotary motion through a preassigned angle.

A pair of supporting columns 37 are fixedly mounted on the respective slide plates 36 adjacent the front ends thereof, seen to the left in Figures 7 and 9, and a front table 38 is rotatably supported by these columns 37 via collars 39. The columns 37 include portions 37*a* projecting upwardly of the front table 38 to rotatably and vertically slidably support a front clamping platen 40 in a horizontal disposition. Above the front clamping platen 40, a beam 41 is rotatably supported by the projecting column portions 37*a*. A front clamping cylinder 42 that may be actuated either hydraulically or pneumatically is mounted vertically on the beam 41 at the midpoint thereof, and the piston rod 43 of this front clamping cylinder extends downwardly therefrom and is rigidly coupled to the front clamping platen 40.

A pair of parallel spaced slide rails 44, extending in the front-to-rear direction of the butt-splicer 17, are fixedly mounted on the respective slide plates 36. Slidably mounted on the respective slide rails 44 are a pair of carriages 45 securely supporting a pair of supporting columns 46 respectively. A rear table 47 is rotatably supported by these columns 46 via collars 48 in coplanar relationship to the front table 38. The columns 46 include portions 46*a* projecting upwardly of the rear table 47 to rotatably and vertically slidably support a rear clamping platen 49 in a horizontal disposition. A beam 50 is rotatably supported by the projecting column portions 46*a* above the rear clamping platen 49, and a rear clamping cylinder 51 mounted vertically on the beam 50 at the midpoint thereof has its piston rod 52 rigidly coupled to the rear clamping platen.

As best shown in Figures 7 and 8, a rotatable shaft 53 extends vertically downwardly from the midpoint of the front table 38 and is operatively connected to a hand wheel 54 as via a worm gearing 55 supported by the mount 30. The shaft 53 is rigidly coupled to the front table 38, so that the revolution of the hand wheel 54 results in the simultaneous angular displacement of the front and rear tables 38 and 47 relative to the cam plates 31, as later described in greater detail.

Another shaft or rod 56 extends vertically downwardly from the midpoint of the rear table 47 and is rotatably coupled at 57 to the piston rod of a splicing cylinder 58 supported on the mount 30. When the piston rod of this splicing cylinder 58 moves to the left, as viewed in Figure 7, on its forward stroke, the rear table 47 will simultaneously travel toward the front table 38 to join the opposed edges of two successive rubberised fabric pieces that are retained in position on the respective tables by the front and rear clamping platens 40 and 49.

Front and rear retractable stops 59 and 60 are pivotally pinned at 61 along the opposed edges of the front and rear tables 38 and 47 respectively. Rotary actuators of any known or suitable construction, seen at 62 and 63 in Figure 2, are operatively connected to the respective retractable stops 59 and 60 in order that these stops may be turned approximately 180 degrees on their pivot pins 61 in both directions between

their operative positions shown in Figures 7 and 9 and their inoperative positions under the respective tables 38 and 47.

As seen in Figure 7, a light emitting diode is embedded at 64 in the front table 38, and a suitable photoelectric element 65 is embedded in the front clamping platen 40 in vertical register with the light emitting diode 64. Another pair of light emitting diode 66 and photoelectric element 67 are likewise embedded in the rear table 47 and the rear clamping platen 49 respectively. The photoelectric elements 65 and 67 coact with the respective light emitting diodes 64 and 66 in the well known manner to sense the rubberised fabric pieces 16 and 16*a* as their opposed edges are fed into abutting contact with the rear and front retractable stops 60 and 59 of the butt-splicer 17 by the forward and backward vibratable conveyors 15 and 18, respectively.

Referring back to Figures 1 and 2, the take-up conveyor 19 provided next to the backward vibratable conveyor 18 can be in the form of an endless moving belt 68 operating over a pair of terminal pulleys 69. A drive mechanism comprising an electric motor 70 and a speed reduction device 71 is coupled to one of the terminal pulleys 69 for driving the take-up conveyor 19 at prescribed time intervals. A dancer roll 72 is pivotally supported at the rear end of the take-up conveyor 19 and is operatively coupled to a hydraulic or pneumatic cylinder 73 thereby to be pivoted up and down for purposes hereinafter made apparent.

The operation of the preferred form of the splicing apparatus according to the invention will now be described with reference directed to Figures 11A to 11H and Figure 12 as well. Before setting the complete apparatus of Figures 1 and 2 in operation, the working angle θ of the front and rear tables 38 and 47 of the butt-splicer 17 relative to the longitudinal axis of the splicing apparatus must be adjusted to the angle ϕ at which each rubberised fabric piece to be spliced is cut as indicated in Figure 2.

This adjustment of the angular position of the front and rear tables 38 and 47 can be effected by the manual revolution of the hand wheel 54. The revolution of the hand wheel 54 is transmitted via the worm gearing 55 to the shaft 53 and thence to the front table 38, thereby causing the latter to displace angularly about the shaft 53 in a horizontal plane. Since the front table 38 is rotatably connected at both lateral ends thereof to the supporting columns 37 fixedly mounted on the respective slide plates 36, the angular displacement of the front table results in the movements in the opposite directions of the slide plates as guided by the arcuate slots 32 and 33 of the cam plates 31 slidably receiving the cam follower pins 34 and 35. The angular positions of the front and rear tables 38 and 47 can thus be simultaneously adjusted to the angle at which each rubberised fabric piece is cut, with the parallel relationship of the opposed edges of the front and rear tables held unchanged. It will be apparent that the front and rear clamping platens 42 and 49, the front and rear retractable stops 59 and 60 and so forth undergo angular displacement in step with the front and rear tables 38 and 47.

It may be recalled that the rubberised fabric pieces shown in Figure 2 are intended for use in the manufacture of radial-ply tires, so that each piece has an angle ϕ of 90 degrees. The front and rear tables 38 and 47 are correspondingly shown at a working angle θ of 90 degrees. For handling bias-cut pieces of rubberised fabric, the working angle θ of the front and rear tables must of course be made acute in conformity with the acute angle ϕ of such bias-cut rubberised fabric pieces.

With reference to Figure 11A, the piston rod of the splicing cylinder 58 is then caused to retract so that the rear table 47 together with the rear clamping platen 49 and so forth moves away from the front table 38. The front and rear retractable stops 59 and 60 are mounted along the opposed edges of the front and rear tables 38 and 47 respectively. are then pivoted upwardly by the respective rotary actuators 62 and 63. The widths of the marginal edge portions of two consecutive rubberised fabric pieces 16 and 16*a* to be butt-spliced, which may usually be in the range of from about 5.0 to 3 millimeters, can be selectively determined in accordance with the horizontal spacings between the front and rear retractable stops 59 and 60 in their operative positions and the opposed edges of the front and rear tables 38 and 47 respectively.

Further with reference to Figure 11A, the piston rods 43 and 52 of the front and rear clamping cylinders 42 and 51 are caused to retract so that the front and rear clamping platens 40 and 49 are both elevated away from the front and rear tables 38 and 47 respectively. The dancer roll 72 may be pivoted upwardly by the cylinder 73. With the preliminary adjustments of the various working parts of the splicing apparatus thus completed, the parallelogrammatic pieces of rubberised fabric may now be successively loaded onto the forward vibratable conveyor 15. The succeeding description of splicing operation will be better understood by referring also to the time chart of Figure 12, in addition to the sequential representation of operating steps given in Figures 11B to 11H.

In the condition represented by Figure 11B, the forward vibratable conveyor 15 is set in high speed operation, and the dancer roll 72 is pivoted downwardly. The back-

ward vibratable conveyor 18 may be maintained in low speed operation throughout the complete cycle of splicing operation. The rubberised fabric piece 16 that has been loaded onto the forward vibratable conveyor 15 as through a chute, not shown, is thereby fed forwardly onto the rear table 47 of the butt-splicer 17. Since it is highly unlikely that the edge $\overline{bc}$ of the rubberised fabric piece 16 should make any neat contact with the guide plate 22 when the same is first deposited on the plate 20, the position of the rubberised fabric piece must be readjusted so that its edge $\overline{bc}$ will be neatly held against the guide plate before its leading edge $\overline{ab}$ reaches the rear retractable stop 60 of the butt-splicer 17. It is to this end that the plate 20 is inclined toward the guide plate 22, and that the perforations 29 are formed through the guide plate.

The rubberised fabric piece 16 is thus fed onto the rear table 47 of the butt-splicer 17 in a correctly oriented manner, with part of its edge $\overline{bc}$ still held in substantially neat contact with the guide plate 22. Preferably, the vibrator 25 of the forward vibratable conveyor 15 should be switched from high to low speed operation when the leading edge of the rubberised fabric piece passes a prescribed position adjacent the rear retractable stop 60. By thus driving the forward vibratable conveyor at low speed matching the pliancy of the rubberised fabric piece, the same will produce no slack when succeedingly fed against the rear retractable stop 60.

As the dancer roll 72 is pivoted downwardly as previously mentioned, the backward vibratable conveyor 18 takes up the slack of the already spliced rubberised fabric pieces, so that the precedingly spliced rubberised fabric piece 16*a* is fed backwardly until its trailing edge comes into abutting contact with the front retractable stop 59 of the butt-splicer 17. Since the backward vibratable conveyor 18 is of the same construction as the forward vibratable conveyor 15 except for the direction of vibrations imparted to the rubberised fabric pieces, the precedingly spliced rubberised fabric piece 16*a* can be neatly held against the guide plate 22 before its trailing edge comes into abutting contact with the front retractable stop 59.

The fact that the rubberised fabric pieces 16*a* and 16 have been fed to the prescribed positions on the front and rear tables 38 and 47 of the butt-splicer 17 is sensed by the photoelectric elements 65 and 67 cooperating with the respective light emitting diodes 64 and 66. The electric signals produced resultantly by the photoelectric elements 65 and 67 are utilized to cause the front and rear clamping cylinders 42 and 51 to depress the front and rear clamping platens 40 and 49 respectively. The rubberised fabric pieces 16*a* and 16 are thus tightly pressed against the front and rear tables 38 and 47 respectively, as illustrated in Figure 11C.

In Figure 11D the retractable stops 59 and 60 are shown pivoted downwardly by the respective rotary actuators 62 and 63 to their inoperative positions under the front and rear tables 38 and 47. The splicing cylinder 58 is now actuated to cause the rear table 47 to travel toward the front table 38 until the opposed edges of these tables are forced against each other, thereby butt-splicing the two consecutive rubberised fabric pieces 16*a* and 16 as clearly seen in Figure 11E.

The front and rear clamping cylinders 42 and 51 are then re-actuated to cause the front and rear clamping platens 40 and 49 to rise away from the spliced rubberised fabric pieces 16*a* and 16, as shown in Figure 11F, and immediately thereafter the splicing cylinder 58 is also re-actuated to cause the rear table 47 to travel away from the front table 38 as in Figure 11G.

In Figure 11H the dancer roll 72 is pivoted [illegible]wardly, and the take-up conveyor 19 is [illegible]t in operation to carry the spliced rubberised fabric pieces 16*a* and 16 forwardly until the trailing edge of the rubberised fabric piece 16 passes the light emitting diode 64 and photoelectric element 65. Preferably, the take-up conveyor 19 should first be set in high speed operation and then switched to low speed operation when the rubberised fabric piece 16 approaches its prescribed standby position spanning the front table 38 and the backward vibratable conveyor 18. The front and rear retractable stops 59 and 60 are pivoted upwardly to their operative positions above the plane of the front and rear tables 38 and 47.

One cycle of splicing operation is thus completed, and the next cycle is initiated as another parallelogrammatic piece of rubberised fabric is loaded onto the forward vibratable conveyor 15. Although the controls of the apparatus are not specifically illustrated because of their rather common nature, it will be apparent to those skilled in the art that the above described cycle of operation can be repeated sequentially and fully automatically by synchronizing the operations of the various working parts or components of the apparatus.

WHAT WE CLAIM IS:—

1. Apparatus for successively splicing parallelogrammatic pieces of rubberised fabric without overlap, comprising in combination:

(a) a forward vibratable conveyor for

successively feeding the pieces of rubberised fabric forwardly by vibration, said forward vibratable conveyor including means for reorienting and guiding lateral edges of the successive pieces of rubberised fabric travelling thereon;

(b) a butt-splicer for joining the successive pieces of rubberised fabric end to end without overlap, said butt-splicer including:

(1) a rear table mounted forwardly of said forward vibratable conveyor for receiving the successive pieces of rubberised fabric therefrom, said rear table having an edge remote from said forward vibratable conveyor;

(2) a rear retractable stop;

(3) means for moving said rear retractable stop between an operative position for arresting the forward movement of each piece of rubberised fabric in a prescribed position on said rear table and an inoperative position away from the plane of said rear table, the piece of rubberised fabric having its leading edge projecting a prescribed distance beyond said edge of said rear table when stopped in said prescribed position thereon;

(4) a rear clamping platen;

(5) means for moving said rear clamping platen between an operative position for clamping the piece of rubberised fabric against said rear table in said prescribed position and an inoperative position for releasing the same;

(6) a front table mounted forwardly of said rear table in coplanar relationship thereto, said front table having an edge opposed to said edge of said rear table;

(7) a front retractable stop;

(8) means for moving said front retractable stop between an operative position for arresting in a prescribed position on said front table the movement of the precedingly spliced piece of rubberised fabric as the same is fed backwardly and an inoperative position away from the plane of said front table, the precedingly spliced piece of rubberised fabric having its trailing edge projecting a prescribed distance beyond said edge of said front table when stopped in said prescribed position thereon;

(9) a front clamping platen;

(10) means for moving said front clamping platen between an operative position for clamping the precedingly spliced piece of rubberised fabric against said front table in said prescribed position thereon and an inoperative position for releasing the same; and

(11) means for moving at least one of said front and rear tables towards and away from the other whereby said opposed edges of said front and rear tables can be forced into abutting contact with each other for splicing operation;

(c) a backward vibratable conveyor mounted forwardly of said butt-splicer for selectively feeding the precedingly spliced piece of rubberised fabric backwardly to said butt-splicer by vibration, said backward conveyor including means for reorienting the piece of rubberised fabric travelling backwardly thereon; and

(d) take-up means for carrying the spliced pieces of rubberised fabric away from said butt-splicer via said backward vibratable conveyor by indexed movement.

2. Apparatus as claimed in claim 1, wherein each of said forward and backward vibratable conveyors comprises:

(a) a flat plate having a perforated guide plate along one of the lateral edges thereof, said flat plate being inclined at least toward said guide plate; and

(b) means for imparting vibration to said flat plate.

3. Apparatus as claimed in claim 1, further including means for simultaneously changing the angular positions of said front and rear tables in a horizontal plane in accordance with the shape of each piece of rubberised fabric to be spliced.

4. Apparatus as claimed in claim 3, wherein said simultaneously changing means comprises:

(a) cam plate means disposed horizontally;

(b) slide plate means slidably mounted on said cam plate means and thereby constrained to rotary motion through a prescribed angle;

(c) a first pair of columns supported on said slide plate means and rotatably supporting said front table;

(d) a second pair of columns supported on said slide plate means and rotatably supporting said rear table; and

(e) manually actuatable means for simultaneously causing angular displacement of said front and rear tables relative to said cam plate means.

5. Apparatus as claimed in claim 4, wherein said first pair of columns include portions projecting upwardly of said front table to rotatably and vertically slidably support said front clamping platen, and wherein said second pair of columns also include portions projecting upwardly of said rear table to rotatably and vertically slidably support said rear clamping platen, whereby said front and rear clamping platens are angularly displaced simultaneously with said front and rear tables.

6. Apparatus as claimed in claim 4, wherein said means for moving at least one of said front and rear tables toward and away from the other comprises:

(a) slide rail means mounted horizontally on said slide plate means;

(b) carriage means slidably mounted on said slide rail means, said second pair of columns being supported on said slide plate means via said carriage means;

(c) a rod extending vertically from said rear table along the axis of rotation thereof; and

(d) means rotatably coupled to said rod for causing said rear table to travel toward and away from said front table along said slide rail means.

7. Apparatus as claimed in claim 1, further comprising:

(a) a dancer roll arranged between said backward vibratable conveyor and said take-up means and underlying the spliced pieces of rubberised fabric; and

(b) means for selectively moving said dancer roll up and down, said dancer roll permitting the precedingly spliced piece of rubberised fabric to be fed backwardly to said butt-splicer by said backward vibratable conveyor when moved downwardly.

8. Apparatus for successively splicing parallelagrammatic pieces of rubberised fabric substantially as herein described with reference to and as illustrated in the accompanying drawings.

For the Applicants:
G. F. REDFERN & CO.,
St. Martin's House,
Brighton, Sussex.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1976.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.

1441077 COMPLETE SPECIFICATION
8 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

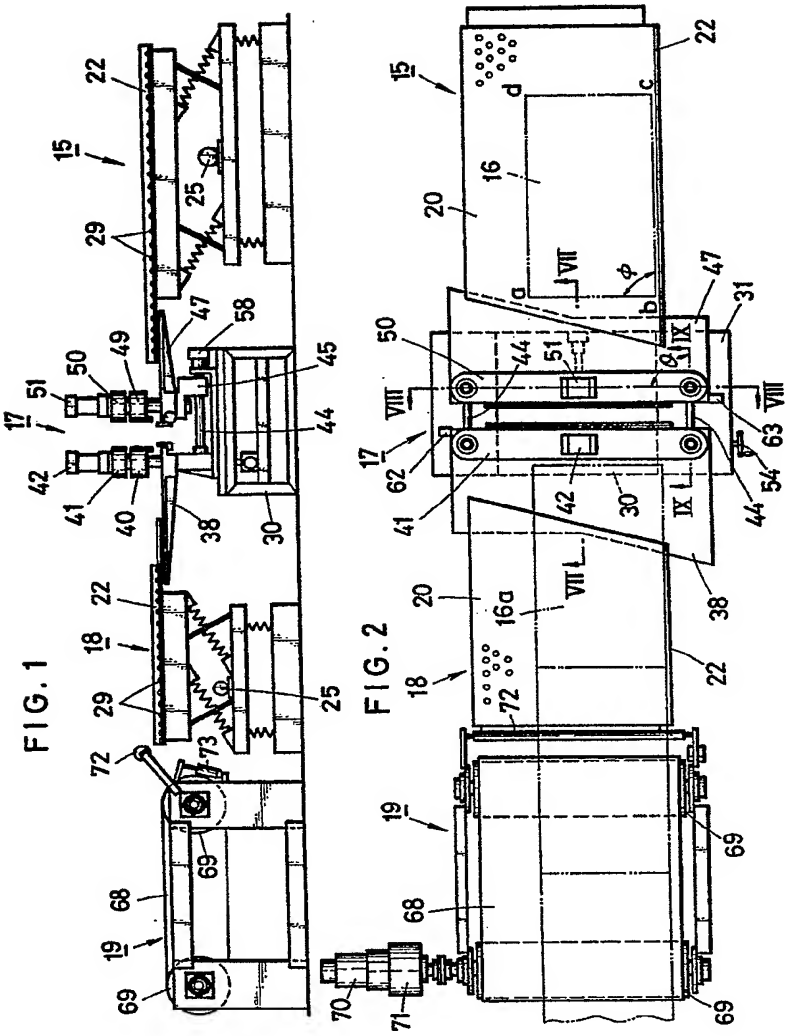

FIG. 1

FIG. 2

FIG. 3

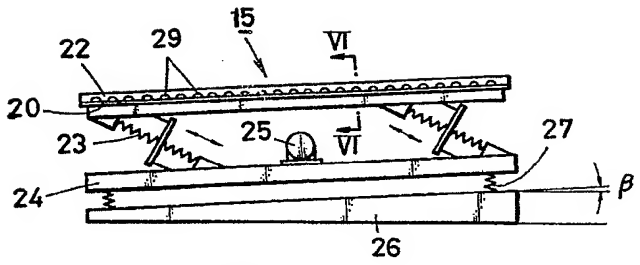

FIG. 4

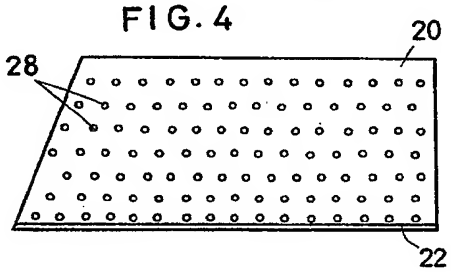

FIG. 5

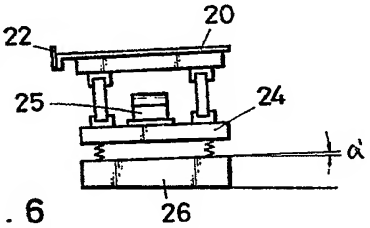

FIG. 6

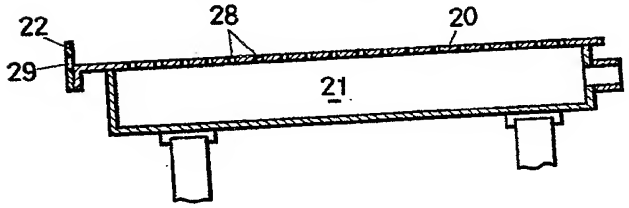

FIG. 7

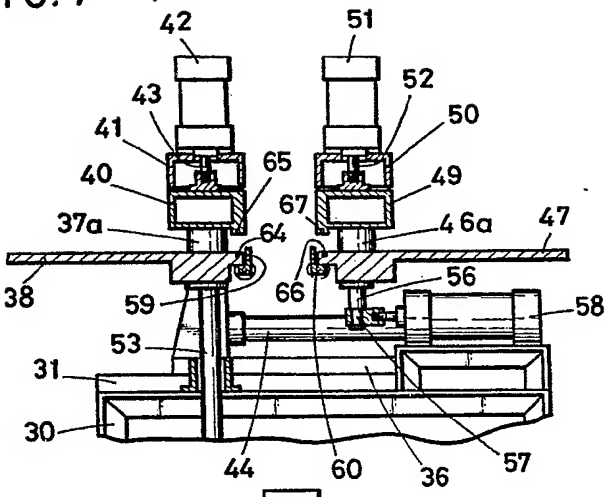
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FIG. 8

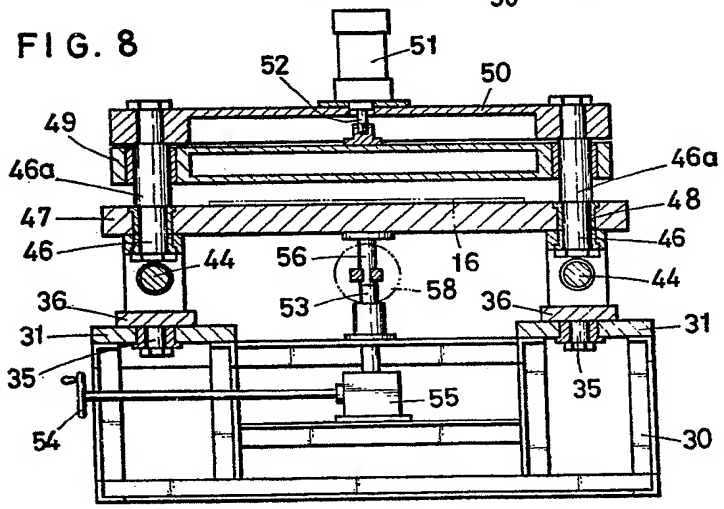
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FIG. 9

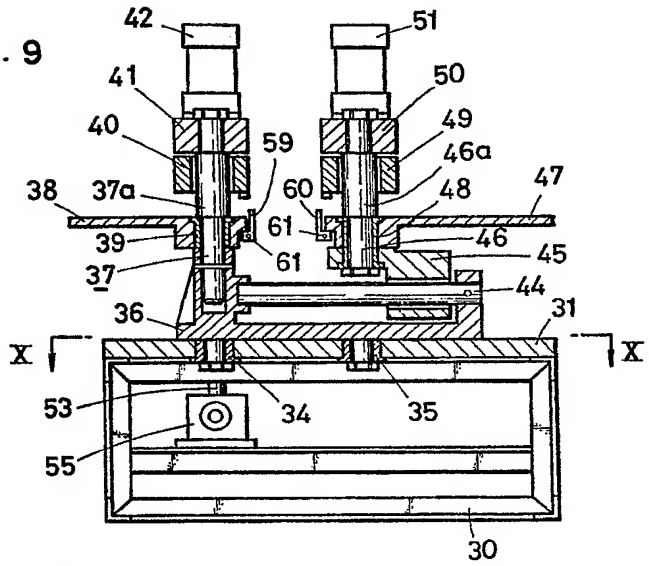

FIG. 10

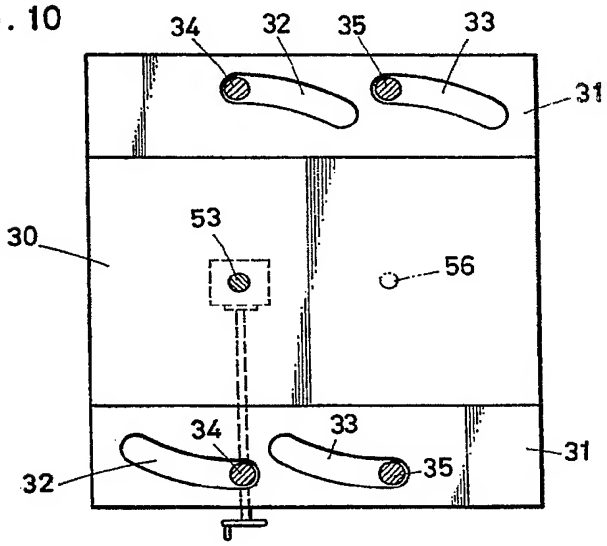

FIG.11A

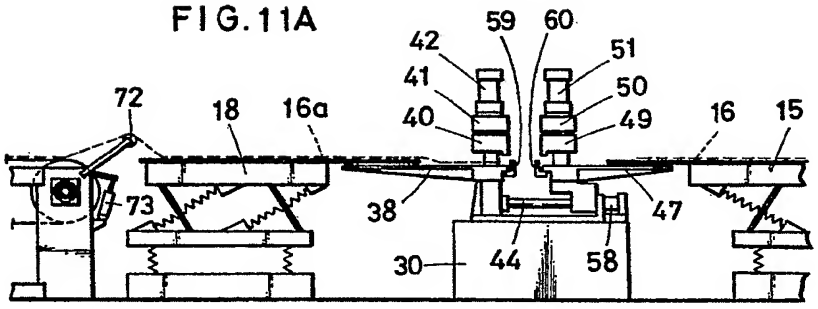

FIG.11B

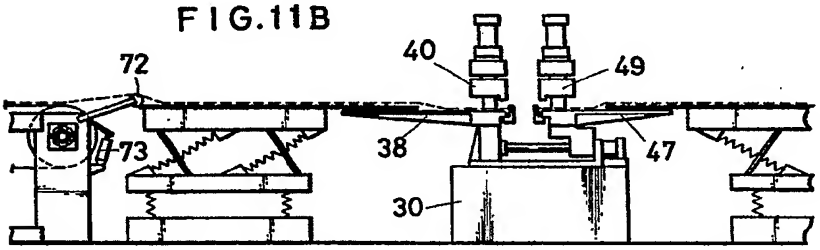

FIG.11C

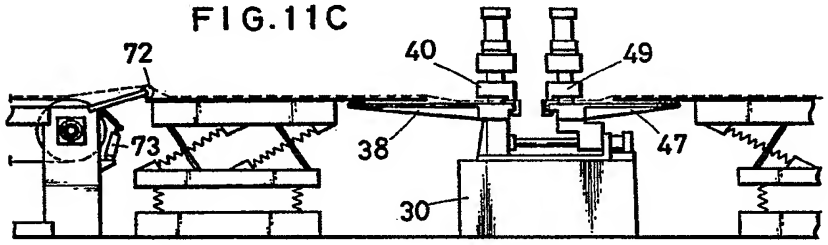

FIG. 11D

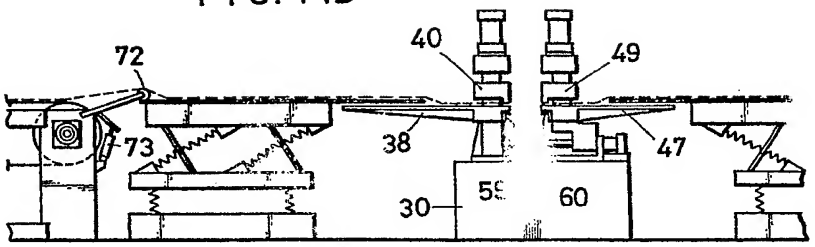

FIG. 11E

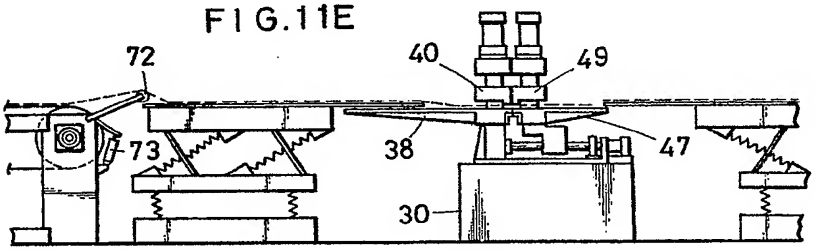

FIG. 11F

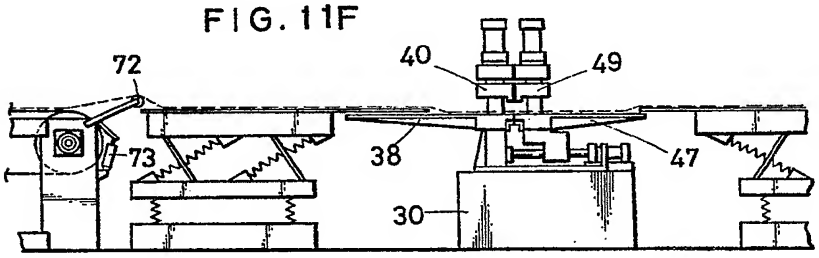

FIG. 11G

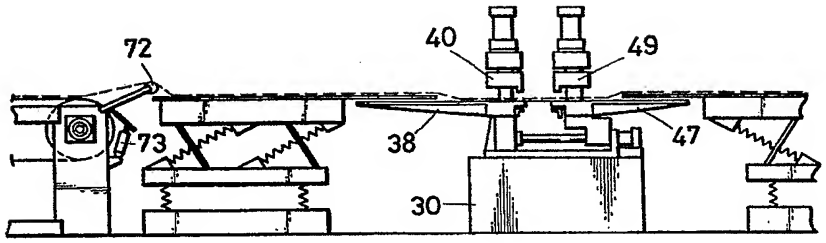

FIG. 11H

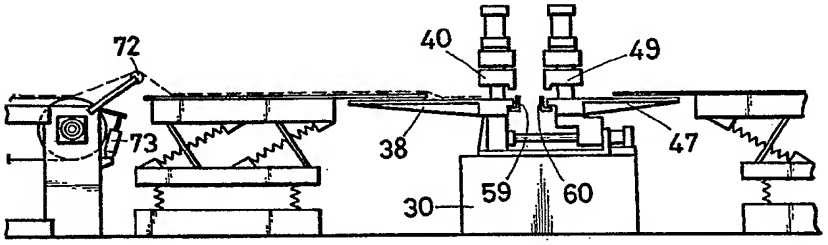

FIG. 12